Space Weather Technical Forecast

Issued on Thursday, 03 March 2022 at 01:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: G1/Minor Geomagnetic Storm likely early day 2 (4th). Increasing Chance of R1 Minor Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate, with occasional C-class flares and one M2 flare at 02/1739 UTC. There are currently four numbered sunspot regions and one unnumbered region on the visible disc, with AR2956 in the northeast recently fading to plage. AR2954 and 2955 remain single stable, mature Hsx/Alpha spots in the northwest quadrant. AR2857 in the southeast quadrant, has continue to grow, and is now classified Dai/Beta. It was the source region which produced a drawn out C3 flare at 02/0940 UTC. This produced a CME that has been analysed and is unlikely to affect Earth. To the northwest of 2857 a new (unnumbered) region has developed and is currently classified Cro/Beta. The unlikely source of the M-flare was AR2958 in the northeast, at the time it was classified Cro/Beta, but it has subsequently decayed and is now Bxo/Beta.
No other Earth directed CMEs were observed in the available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, gradually declined from around 500 km/s to around 420 Km/s through the period. The solar wind density also decreased from slightly above average at the start of the period (~13 ppcc) to below average by the end (<5 ppcc). The Total IMF (Bt) was weak throughout (<5nT), with the north-south component (Bz) ranging between +3 and -3 nT. The phi angle was largely positive (away from the sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured at GOES 16 was at Background levels. The high energy electron flux (greater than 2 MeV) was a background levels for much of the period. The corresponding 24-hour integrated electron fluence was well below the Active (1e8 integrated pfu) threshold with a flat trend. The 03/0000 UTC observation was 2.1e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low, with occasional C-class flares. However, there is a chance of increasing to Moderate levels at times, with isolated M-class flares. This risk increases slightly through the period as potential returning regions transit around the eastern limb.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast. Near ambient solar winds and Quiet geomagnetic activity is expected initially. However, late on day 1 (3rd) into day 2 (4th) Earth is expected to connect to the high speed stream from CH61/-, with winds remaining elevated through the rest of the period. Geomagnetic activity is expected to become Quiet to Unsettled with occasional Active intervals. There is a chance of G1/Minor Geomagnetic Storming, most likely early on day 2 (4th).

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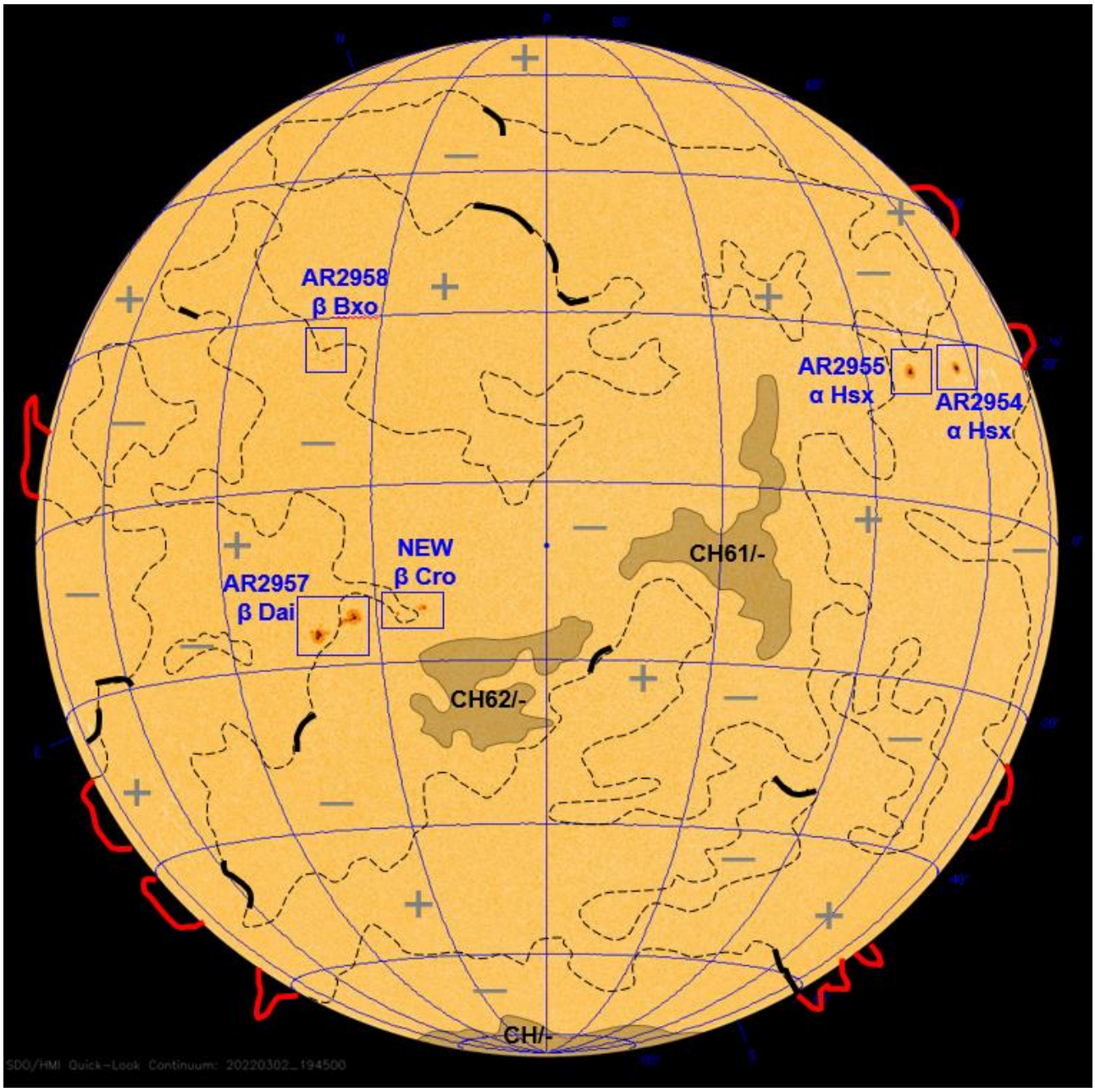
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at Background levels. The high energy electron flux and fluence is likely to exhibit increasing trends early and late in the forecast period. There is a chance that the electron flux may temporarily exceed the High (1e3 pfu) threshold during its peak on day 1 (3rd), however this is unlikely to be sustained long enough for the electron fluence to reach the Active (1e8 integrated pfu) threshold, and thus the fluence is expected to remain below this level throughout.

Figure 1. Solar Analysis Valid 02/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth-directed CMEs that feature in the forecast.
Through much of day 1 (3rd) the solar wind is likely to be close to ambient levels, leading to predominately Quiet geomagnetic activity. However, towards the end of day 1 (3rd) into day 2 (4th) negative coronal hole 61 is expected to move into a geoffective position. Solar winds at Earth are expected to increase to around 500-550km/s, in line to what have recently been observed at STEREO-A. Elevated solar winds are then forecast to continue through the rest of the period. Earth is expected to connect strongly with this feature due its negative polarity and the time of year. G1/Minor Geomagnetic storming is possible, most likely during the CIR event and initial connection the high speed stream. Otherwise, geomagnetic activity is expected to Quiet to Unsettled, with occasional Active intervals

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	40	60	30	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil

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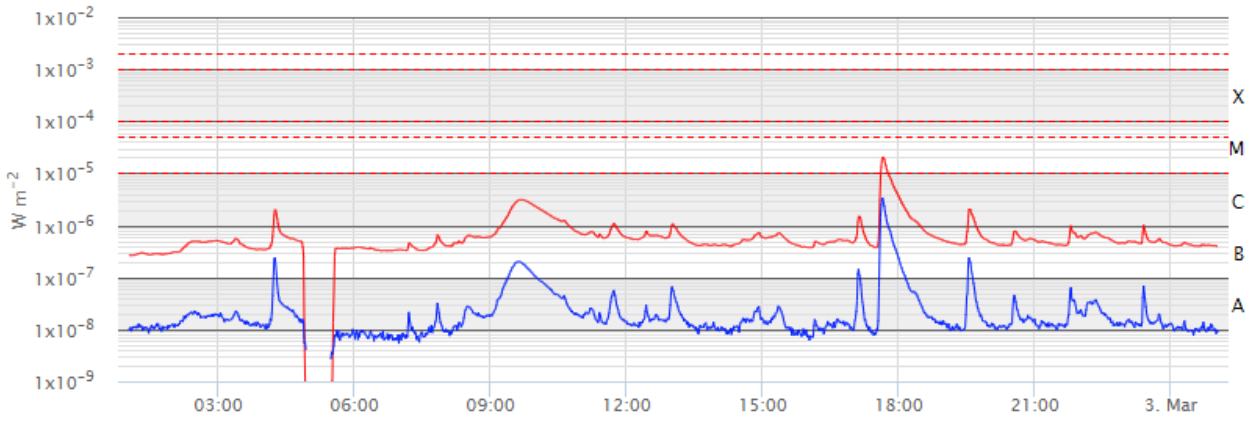
Radio Blackouts - X-Ray Flares:

There are currently 5 active regions on the visible disk. Solar activity has been Moderate over the past 24 hours, with occasional C-class flares and an M2 flare observed at 02/1739 UTC. This originated from AR2958 in the northwest, but the most noteworthy region on the disc is currently AR2957, in the southeast, which is classified (Dai/Beta). Two further bright regions, evident on STEREO-A imagery, are expected to rotate around the east limb during the next couple of days.
Solar activity is likely to be Low with further C-class flares, but there is a chance of increasing to Moderate levels at times, with isolated M-class flares. The chance of this increases slightly through the period as the aforementioned regions rotate onto the visible disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	30	30	40
Very Active	R3 to R5 X Class	No	2	5	5	10

Figure 2: GOES 16 observed x-ray flux on 2nd March.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES 16 is at background levels, and expected to remain at this level throughout.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	3	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) has generally been at background levels. It is likely to rise during day 1 (3rd), possibly peaking at High levels (>1000 pfu). However, this enhancement is likely to be short-lived due to the arrival of CH61/- suppressing the Van Allen belts and the electron count. A rising trend is then likely once again later in the forecast period as geomagnetic activity eases. The corresponding electron fluence is also likely to show rising trends early and late in the period, but the Active (1e8 integrated pfu) threshold is not expected to be exceeded during this time frame.
The relevant four-day period from last rotation suffered from CME influences, so REFM guidance and persistence in general is expected to offer less of a steer than would usually be the case, meaning that confidence is lower than usual.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	20	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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